Understanding 3-Dimensional Conduction Channel in Polymer Transistors from Temperature-Dependent Structure/Transport Studies

Sangsik Park[1], Han Wool Park[1], Do Hyung Park[1], Kwang Seok Ahn[2], Hyun Ho Choi[4], Jianguo Mei[6] , Kilwon Cho[4] , Zhenan Bao[5], Dong Ryeol Lee[2,*], Moon Sung Kang[3,*], Do Hwan Kim[1,*]

[1]Dept. of Organic Materials and Fiber Engineering, [2] Dept. of Physics, [3] Dept. of Chemical Engineering Soongsil University, Seoul 156-743, Korea

[4]Dept. of Chemical Engineering, Pohang University of Science and Technology, Pohang 790-784, Korea

[5]Dept. of Chemical Engineering, Stanford University, Stanford, California 94305-5025, United States

[6]Dept. of Chemistry, Purdue University, West Lafayette, Indiana 47907, USA

Tel.:82-02-820-0995, E-mail: dohwan@ssu.ac.kr

Understanding of thermally activated charge transport in polymer semiconductor thin-films is absolutely required because of its critical role in performances of the devices for flexible and stretchable electronics. Herein, we describe the first 3-dimensional charge conduction and molecular scale investigation about its origin in polymer semiconductors via comparative analysis using the isoindigo-based polymers with a siloxane-terminated side-chain (**PII2T-Si**) and a branched alkyl-terminated side-chain (**PII2T-Ref**). Interestingly, for **PII2T-Si** thin-film with a *bimodal* molecular orientation, unlike **PII2T-Ref** with a *unimodal* fashion, the distinct transition of the relevant crystallographic parameters including the π-stacking distance and the coherence length of the lateral crystallites was observed at different temperature regimes, thereby strongly mediating 3-dimensional charge conduction into the channel. We believe that our findings will provide rational design rule to guide next generation polymer semiconductors for high-performance flexible organic electronics.

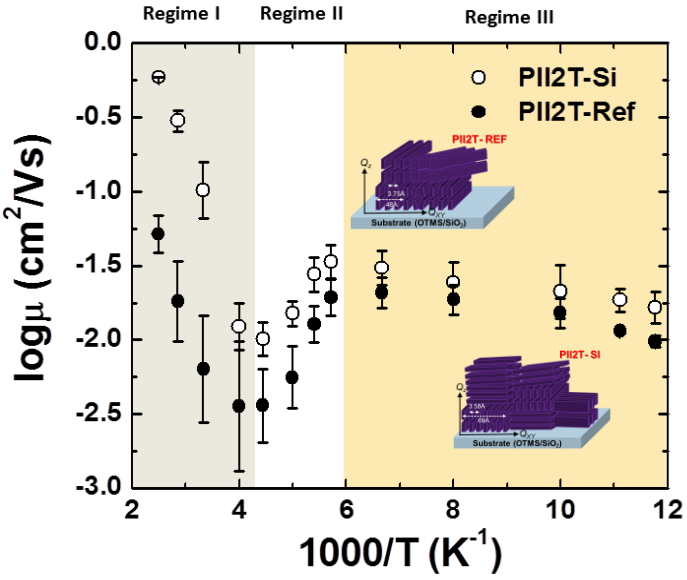

Fig. 1. Averaged hole mobility (μ) of the polymer transistors plotted as a function of inversed temperature

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